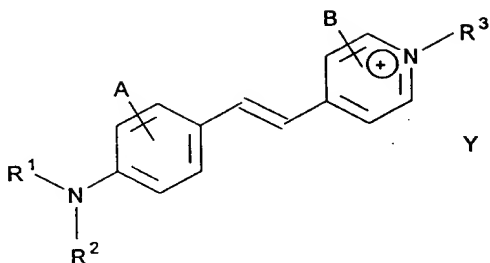


**WHAT IS CLAIMED:**

1. A compound having the formula:



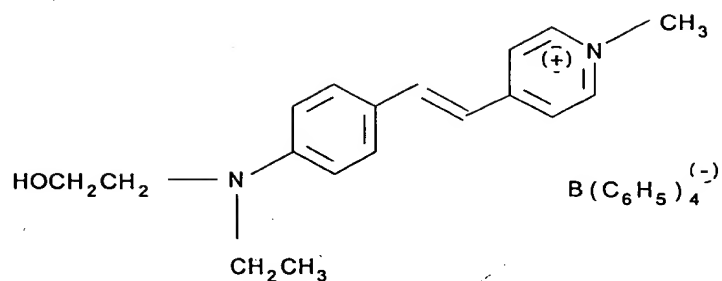
wherein

R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties,

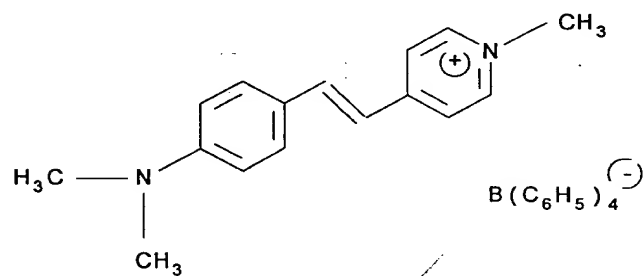
A and B are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion

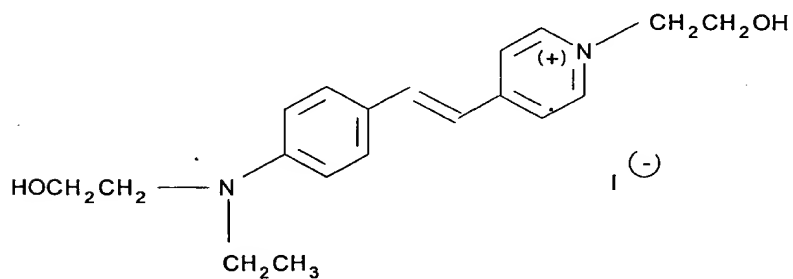
2. A compound according to claim 1, wherein Y is a iodide.
3. A compound according to claim 1, wherein Y is tetraphenylborate.
4. A compound according to claim 1, wherein A and B are hydrogen and R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.
5. A compound according to claim 4, wherein R<sup>2</sup> is unsubstituted alkyl and R<sup>1</sup> and R<sup>3</sup> are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.
6. A compound according to claim 4, having the formula



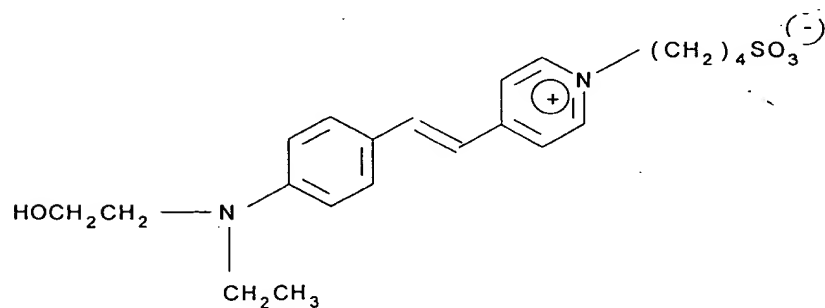
7. A compound according to claim 4, having the formula:



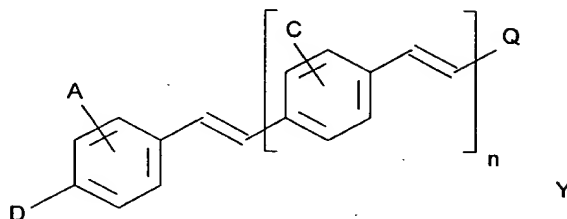
8. A compound according to claim 4, having the formula:



9. A compound according to claim 4, having the formula:



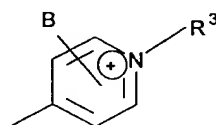
10. A composition comprising:  
a matrix material and  
a compound having the formula:



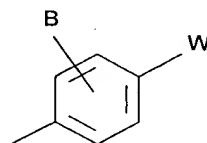
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of  
electron acceptors having the formulae:



and



W is an electron accepting group,

R<sup>3</sup> is selected from the group consisting of substituted or  
unsubstituted alkyl or substituted or unsubstituted aryl moieties,

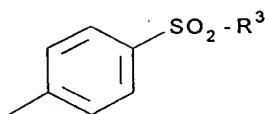
n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each  
independently selected from the group consisting of alkyl, alkoxy,  
hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion

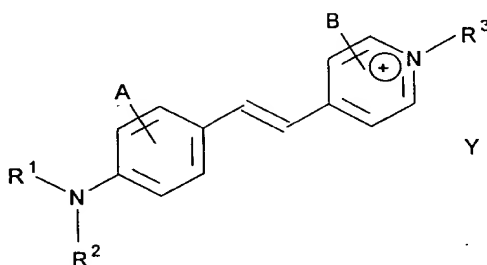
dispersed in said matrix.

11. A composition according to claim 10, wherein n is 0; A is hydrogen; D is an amine having the formula NR<sup>1</sup>R<sup>2</sup>; R<sup>1</sup> and R<sup>2</sup> are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties; and Q has the formula:



12. A composition according to claim 11, wherein  $\text{R}^1$  is 2-hydroxyethyl,  $\text{R}^2$  is methyl, and  $\text{R}^3$  is 6-hydroxyhexyl.

13. A composition according to claim 10, wherein said compound has the formula:



wherein

$\text{R}^1$  and  $\text{R}^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties.

14. A composition according to claim 13, wherein Y is tetraphenylborate.

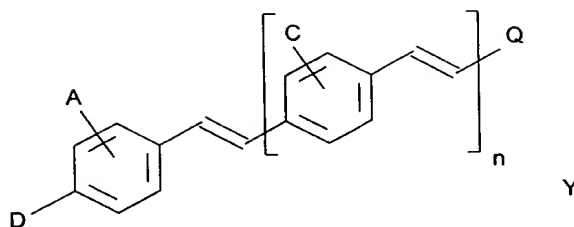
15. A composition according to claim 13, wherein A and B are hydrogen and  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

16. A composition according to claim 15, wherein  $\text{R}^2$  is unsubstituted alkyl and  $\text{R}^1$  and  $\text{R}^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

17. A composition according to claim 10, wherein said matrix material is a polymer.

18. A composition according to claim 17, wherein the polymer is selected from the group consisting of a polyurethane, a polyester, a polyalkylacrylic acid or ester, an epoxy, a polyimide, a polyamide, a phenal-formaldehyde polymer, a urea-formaldehyde polymer, a melamine-formaldehyde polymer, and mixtures thereof.

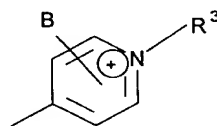
19. A composition according to claim 10, wherein said matrix material is a glass.
20. A composition according to claim 10, wherein said matrix material is a liquid.
21. A composition according to claim 10, wherein said compound is present in said matrix material in a concentration from about 0.001 M to about 0.1 M.
22. A composition according to claim 21, wherein said compound is present in said matrix material in a concentration from about 0.0015 M to about 0.01 M.
23. A composition according to claim 10, wherein the composition is a free standing film.
24. A composition according to claim 23, wherein the film is from about 0.001 to about 1 mm thick.
25. A composition according to claim 10, wherein said composition forms a coating on a substrate.
26. A composition according to claim 25, wherein the coating is from about 0.01 to about 0.05 mm thick.
27. A composition according to claim 10, wherein said composition forms a fiber.
28. A composition according to claim 10, wherein said composition forms a three dimensional solid having at least two parallel sides separated by a distance from about 2 to about 20 mm.
29. A method of detecting infrared radiation comprising:  
placing a compound having the formula:



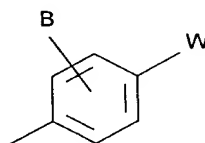
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

R<sup>3</sup> is selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties,

n is an integer from 0 to 4,

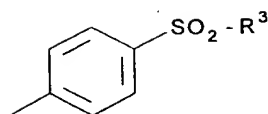
A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion

at a location potentially exposed to the infrared radiation and

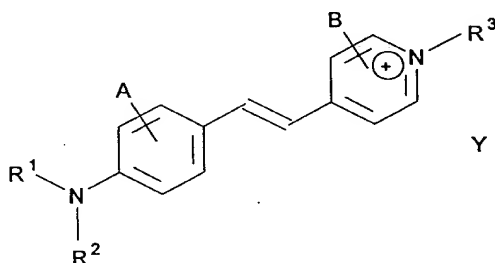
evaluating whether the compound has been exposed to the infrared radiation at the location.

30. A method according to claim 29, wherein n is 0; A is hydrogen; D is an amine having the formula NR<sup>1</sup>R<sup>2</sup>; R<sup>1</sup> and R<sup>2</sup> are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties; and Q has the formula:



31. A method according to claim 30, wherein  $\text{R}^1$  is 2-hydroxyethyl,  $\text{R}^2$  is methyl, and  $\text{R}^3$  is 6-hydroxyhexyl.

32. A method according to claim 29, wherein the compound has the formula:



wherein

$\text{R}^1$  and  $\text{R}^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties.

33. A method according to claim 32, wherein  $\text{Y}$  is tetraphenylborate.

34. A method according to claim 32, wherein  $\text{A}$  and  $\text{B}$  are hydrogen and  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

35. A method according to claim 34, wherein  $\text{R}^2$  is unsubstituted alkyl and  $\text{R}^1$  and  $\text{R}^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

36. A method according to claim 29, wherein the compound is dispersed in a matrix material.

37. A method according to claim 36, wherein the matrix material is a polymer.

38. A method according to claim 37, wherein the polymer is selected from the group consisting of a polyurethane, a polyester, a polyalkylacrylic acid or ester, an epoxy, a polyimide, a polyamide, a phenol-formaldehyde polymer, a urea-formaldehyde polymer, a melamine-formaldehyde polymer, and mixtures thereof.

39. A method according to claim 36, wherein the matrix material is a glass.

40. A method according to claim 36, wherein the matrix material is a liquid.

41. A method according to claim 36, wherein the compound is present in the matrix material in a concentration from about 0.001 M to about 0.1 M.

42. A method according to claim 41, wherein the compound is present in the matrix material in a concentration from about 0.0015 M to about 0.01 M.

43. A method according to claim 29, wherein the infrared radiation has a wavelength from about 700 to about 1300 nm.

44. A method according to claim 29, wherein the infrared radiation is laser radiation produced by a Nd-YAG laser.

45. A method of detecting cross-sectional shape of an infrared laser beam comprising:

detecting infrared radiation in accordance with the method of claim 29 at various locations potentially exposed to an infrared laser beam and correlating the infrared radiation detected at the various locations to the cross-sectional shape of the infrared laser beam.

46. A method of detecting cross-sectional intensity profile of an infrared laser beam comprising:

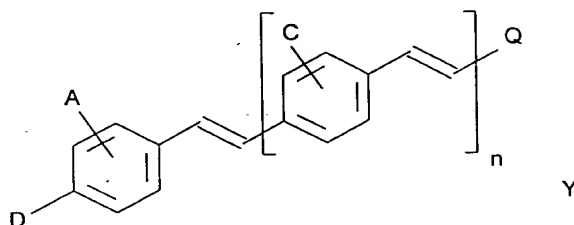
detecting infrared radiation intensity in accordance with the method of claim 29 at various locations potentially exposed to an infrared laser beam and correlating the infrared radiation intensity detected at the various locations to the cross-sectional intensity profile of the infrared laser beam.

47. A method of detecting a temporal intensity profile of an infrared laser beam comprising:

detecting infrared radiation intensity at a location potentially exposed to an infrared laser beam in accordance with the method of claim 29 at various times and

correlating the infrared radiation intensity detected at the various times with the temporal intensity profile of the infrared laser beam.

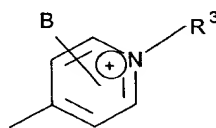
48. A method for reducing intensity of infrared radiation comprising:  
providing a compound having the formula:



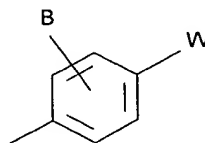
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

R<sup>3</sup> is selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties,

n is an integer from 0 to 4,

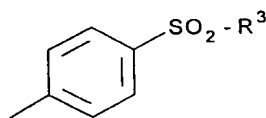
A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion

and

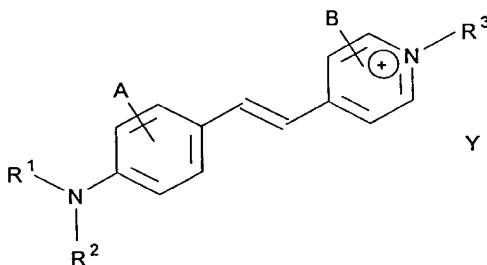
passing infrared radiation through the compound, whereby the compound reduces intensity of the infrared radiation.

49. A method according to claim 48, wherein n is 0; A is hydrogen; D is an amine having the formula  $NR^1R^2$ ;  $R^1$  and  $R^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties; and Q has the formula:



50. A method according to claim 49, wherein  $R^1$  is 2-hydroxyethyl,  $R^2$  is methyl, and  $R^3$  is 6-hydroxyhexyl.

51. A method according to claim 48, wherein the compound has the formula:



wherein

$R^1$  and  $R^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties.

52. A method according to claim 51, wherein  $Y$  is tetraphenylborate.

53. A method according to claim 51, wherein  $A$  and  $B$  are hydrogen and  $R^1$ ,  $R^2$ , and  $R^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

54. A method according to claim 53, wherein  $R^2$  is unsubstituted alkyl and  $R^1$  and  $R^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

55. A method according to claim 48, wherein the compound is dispersed in a matrix material.

56. A method according to claim 55, wherein the matrix material is a polymer.

57. A method according to claim 56, wherein the polymer is selected from the group consisting of a polyurethane, a polyester, a polyalkylacrylic acid or ester, an epoxy, a polyimide, a polyamide, a phenal-formaldehyde polymer, a urea-formaldehyde polymer, a melamine-formaldehyde polymer, and mixtures thereof.

58. A method according to claim 55, wherein the matrix material is a glass.

59. A method according to claim 55, wherein the matrix material is a liquid.

60. A method according to claim 55, wherein the compound is present in the matrix material in a concentration from about 0.001 M to about 0.1 M.

61. A method according to claim 60, wherein the compound is present in the matrix material in a concentration from about 0.0015 M to about 0.01 M.

62. A method according to claim 48, wherein the infrared radiation has a wavelength from about 700 to about 1300 nm.

63. A method according to claim 48, wherein the infrared radiation is laser radiation produced by a Nd-YAG laser.

64. A method for protecting a sensitive infrared detector from damage caused by intense radiation comprising:

reducing intensity of infrared radiation according to the method of claim 48 by placing the compound between the sensitive infrared detector and a source of infrared radiation.

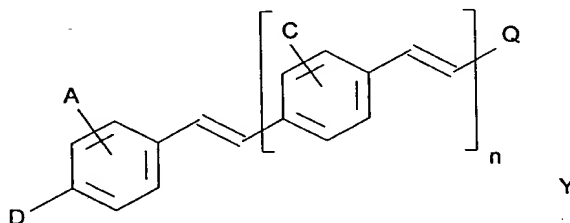
65. An device for detecting infrared radiation comprising:  
an infrared detector and

a window comprising a compound according to claim 1 positioned at a location where incident infrared radiation passes through the window prior to entering said detector.

66. Eye wear having transparent surfaces containing a compound according to claim 1.

67. A method for converting infrared radiation to visible radiation comprising:

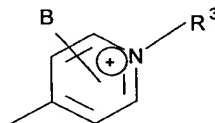
providing a compound having the formula:



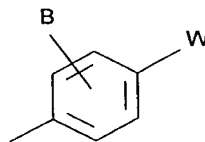
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

$R^3$  is selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties,

n is an integer from 0 to 4,

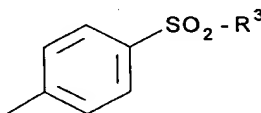
A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion

and

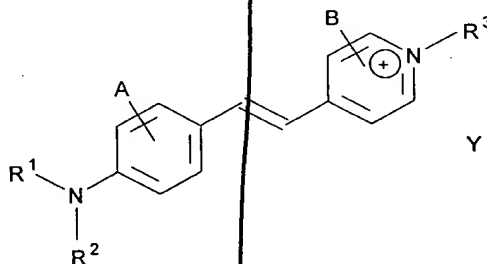
exposing the compound to infrared radiation, whereby the compound converts the infrared radiation to visible radiation.

68. A method according to claim 67, wherein n is 0; A is hydrogen; D is an amine having the formula  $NR^1R^2$ ;  $R^1$  and  $R^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties; and Q has the formula:



69. A method according to claim 68, wherein  $R^1$  is 2-hydroxyethyl,  $R^2$  is methyl, and  $R^3$  is 6-hydroxyhexyl.

70. A method according to claim 67, wherein the compound has the formula:



wherein

$R^1$  and  $R^2$  are the same or different and are selected from the group consisting of substituted or unsubstituted alkyl or substituted or unsubstituted aryl moieties.

71. A method according to claim 70, wherein Y is tetraphenylborate.

72. A method according to claim 70, wherein A and B are hydrogen and  $R^1$ ,  $R^2$ , and  $R^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

73. A method according to claim 72, wherein  $R^2$  is unsubstituted alkyl and  $R^1$  and  $R^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

74. A method according to claim 67, wherein the compound is dispersed in a matrix material.

75. A method according to claim 74, wherein the matrix material is a polymer.

76. A method according to claim 75, wherein the polymer is selected from the group consisting of a polyurethane, a polyester, a polyalkylacrylic acid or ester, an epoxy, a polyimide, a polyamide, a phenol-formaldehyde polymer, a urea-formaldehyde polymer, a melamine-formaldehyde polymer, and mixtures thereof.

77. A method according to claim 74, wherein the matrix material is a glass.

78. A method according to claim 74, wherein the matrix material is a liquid.

79. A method according to claim 74, wherein the matrix material is a glass or a polymer in the form of an optical fiber.

80. A method according to claim 74, wherein the matrix material is a glass or a polymer in the form of a three dimensional solid having at least two parallel sides separated by a distance from 2 to 20 mm.

81. A method according to claim 74, wherein the compound is present in the matrix material in a concentration from about 0.001 M to about 0.1 M.

82. A method according to claim 81, wherein the compound is present in the matrix material in a concentration from about 0.0015 M to about 0.01 M.

83. A method according to claim 67, wherein the infrared radiation has a wavelength from about 700 to about 1300 nm.

84. A method according to claim 67, wherein the infrared radiation is laser radiation produced by a Nd-YAG laser.

85. A method according to claim 67, wherein the visible radiation is coherent.
86. A method according to claim 67, wherein the visible radiation is incoherent.
87. A method according to claim 67, wherein the visible radiation has a wavelength from about 350 to about 680 nm.
88. A laser comprising:  
a source capable of producing infrared radiation and  
a compound according to claim 1 positioned at a location where infrared radiation from said source exposes said compound, whereby said compound converts the infrared radiation to visible radiation.
89. A composite comprising  
a glass having pores, the pores having a pore surface;  
a coating material on the pore surface; and  
a polymeric material in the pores.
90. A composite according to claim 89, wherein the pores have an average diameter of from about 20 to about 500 Å.
91. A composite according to claim 89, wherein said glass has a specific surface area of from about 200 to about 1000 m<sup>2</sup>/g of glass.
92. A composite according to claim 89, wherein said glass has a pore volume of from about 20 to about 80 %.
93. A composite according to claim 89, wherein said glass is a silica glass.
94. A composite according to claim 89, wherein said polymeric material is poly(methyl methacrylate).
95. A composite according to claim 89, wherein said polymeric material fills the pores.
96. A composite according to claim 89, wherein said coating material is optically responsive.

97. A composite according to claim 96, wherein said optically responsive coating material has a nonlinear optical response.

98. A composite according to claim 96, wherein said optically responsive coating material is a laser dye.

99. A composite according to claim 98, wherein the laser dye is trans-4-[p-(N-ethyl-N-hydroxyethylamino)styryl]-N-hydroxyethylpyridinium iodide.

100. A composite according to claim 98, wherein the laser dye is present in a concentration of from about  $10^{-7}$  to about  $10^{-1}$  mg/cm<sup>3</sup> of said glass.

101. A composite according to claim 96, wherein said optically responsive coating material is an optical power limiter.

102. A composite according to claim 101, wherein the optical power limiter is a fullerene.

103. A composite according to claim 102, wherein the fullerene is C<sub>60</sub>.

104. A composite according to claim 89, further comprising:  
a dispersed material in said polymeric material.

105. A composite according to claim 104, wherein said dispersed material is optically responsive.

106. A composite according to claim 105, wherein said optically responsive dispersed material has a non-linear optical response.

107. A composite according to claim 105, wherein said optically responsive dispersed material is a laser dye.

108. A composite according to claim 107, wherein the laser dye is Rhodamine G.

109. A composite according to claim 107, wherein the laser dye is present in a concentration of from about  $10^{-7}$  to about  $10^{-1}$  mg/cm<sup>3</sup> of said glass.

110. A composite according to claim 104, wherein said coating material is a first laser dye and said dispersed material is a second laser dye.

111. A composite according to claim 110, wherein one of said first laser dye and said second laser dye quenches the other laser dye's optical response when said first laser dye and said second laser dye are in a single solution.

112. A composite according to claim 105, wherein said optically responsive dispersed material is an optical power limiter.

113. A process for producing an optically responsive composite comprising:  
providing a glass having pores, the pores having a pore surface coated with an optically responsive coating material;  
infusing a monomeric material into the pores; and  
permitting the monomeric material to polymerize to produce a polymeric material within the pores.

114. A process according to claim 113, further comprising:  
infusing an optically responsive dispersed material into the pores prior to said permitting the monomer to polymerize.

115. A process according to claim 114, wherein said infusing the monomeric material and said infusing the optically responsive dispersed material is effected simultaneously by infusing a composition comprising the monomeric material and the optically responsive dispersed material into the pores.

116. A process according to claim 113, wherein said providing comprises:  
providing a glass having pores, the pores having a pore surface  
and  
coating the optically responsive coating material on the pore surface.

117. A process according to claim 116, wherein said coating comprises:  
providing a composition comprising a solvent and an optically responsive coating material;  
contacting the glass with the composition under conditions effective to infuse the solvent and the optically responsive coating material into the pores of the glass; and  
removing the solvent.

118. A process according to claim 116, wherein said providing a glass having pores comprises:

hydrolyzing and polycondensing one or more alkoxide precursors to form a sol comprising a plurality of particles suspended in a liquid;  
cross-linking the particles to form a gel;  
aging the gel to form an aged gel;  
removing the liquid from the aged gel to form a dried, aged gel;

and

stabilizing the dried, aged gel to produce the glass having pores.

119. A process according to claim 113, wherein the optically responsive coating material is substantially insoluble in the monomeric material and in the polymeric material.

120. A process according to claim 113, wherein the pores have an average diameter of from about 20 to about 500 Å.

121. A process according to claim 113, wherein the glass has a specific surface area of from about 200 to about 1000 m<sup>2</sup>/g of the glass.

122. A process according to claim 113, wherein the glass has a pore volume of from about 20 to about 80 %.

123. A process according to claim 113, wherein the glass is a silica glass.

124. A process according to claim 113, wherein the monomeric material is methyl methacrylate.

125. A process according to claim 113, wherein the polymeric material fills the pores.

126. A process according to claim 113, wherein the optically responsive coating material has a nonlinear optical response.

127. A process according to claim 113, wherein the optically responsive coating material is a laser dye.

128. A process according to claim 127, wherein the laser dye is trans-4-[p-(N-ethyl-N-hydroxyethylamino)styryl]-N-hydroxyethylpyridinium iodide.

129. A process according to claim 127, wherein the laser dye is present in a concentration of from about  $10^{-7}$  to about  $10^{-1}$  mg/cm<sup>3</sup> of said glass.

130. A process according to claim 113, wherein the optically responsive coating material is an optical power limiter.

131. A process according to claim 130, wherein the optical power limiter is a fullerene.

132. A process according to claim 131, wherein the fullerene is C<sub>60</sub>.

133. A process according to claim 114, wherein the optically responsive dispersed material has a non-linear optical response.

134. A process according to claim 114, wherein the optically responsive dispersed material is a laser dye.

135. A process according to claim 134, wherein the laser dye is Rhodamine G.

136. A process according to claim 134, wherein the laser dye is present in a concentration of from about  $10^{-7}$  to about  $10^{-1}$  mg/cm<sup>3</sup> of the glass.

137. A process according to claim 114, wherein the optically responsive coating material is a first laser dye and the optically responsive dispersed material is a second laser dye.

138. A process according to claim 137, wherein one of the first laser dye and the second laser dye quenches the other laser dye's optical response when the first laser dye and the second laser dye are in a single solution.

139. A process according to claim 114, wherein the optically responsive dispersed material is an optical power limiter.

140. A method for reducing intensity of radiation comprising:  
providing a composite according to claim 101 and

passing radiation through the composite, whereby the composite reduces intensity of the radiation.

141. A method according to claim 140, wherein the composite further comprises a nonlinear dispersed material in the polymeric material.

142. A device for detecting radiation comprising:  
a detector and  
a window comprising a composite according to claim 101  
positioned at a location where the incident radiation passes through the window prior to entering said detector.

143. A device according to claim 142, wherein the composite further comprises an optically responsive dispersed material in the polymeric material, wherein the optically responsive dispersed material is an optical power limiter.

144. A method for changing the wavelength of radiation comprising:  
providing a composite according to claim 98, and  
exposing the composite to radiation, whereby the composite changes the wavelength of the radiation.

145. A method according to claim 144, wherein the radiation is laser radiation.

146. A method according to claim 144, wherein the composite further comprises a laser dye dispersed in the polymeric material.

147. A laser which produces output radiation having an output wavelength comprising:  
a source capable of producing input radiation and  
a composite according to claim 98 positioned at a location where the input radiation from said source exposes said composite, whereby said composite converts the input radiation to an output radiation.

148. A laser according to claim 147, wherein the composite further comprises a laser dye dispersed in the polymeric material.

149. A laser according to claim 148, wherein each of the laser dyes has a response range and the laser is tunable through the response range of each of the laser dyes.

150. A method for producing singlet oxygen comprising:  
providing a composition comprising a photosensitizer having absorption at a wavelength from about 380 nm to about 760 nm and a dye capable of converting photons having energies of from about 660 to about 1300 nm to photons having energies of from about 380 to about 760 nm and  
exposing the composition to light having a wavelength of from about 660 nm to about 1300 nm in the presence of oxygen to produce singlet oxygen.

151. A method according to claim 150, wherein the photosensitizer is a singlet oxygen generator.

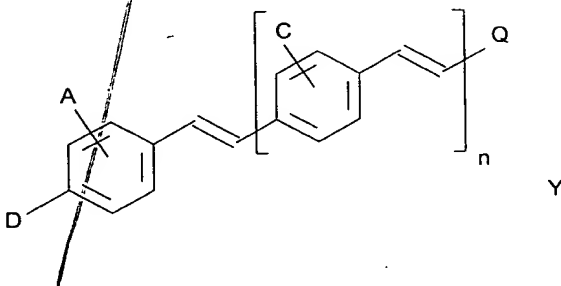
152. A method according to claim 150, wherein the photosensitizer is a photodynamic therapy agent.

153. A method according to claim 150, wherein the photosensitizer is a porphyrin, a porphyrin analog, a phthalocyanine, or a phthalocyanine analog.

154. A method according to claim 150, wherein the photosensitizer is dihematoporphyrin ether.

155. A method according to claim 150, wherein the dye is a two photon upconverter.

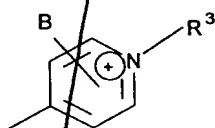
156. A method according to claim 150, wherein the dye is a styryl dye having the formula:



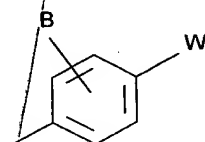
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

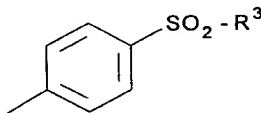
R³ is a substituted or unsubstituted alkyl moiety or a substituted or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

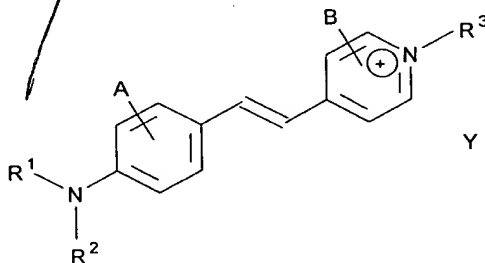
Y is a counterion

157. - A method according to claim 156, wherein n is 0; A is hydrogen; D is an amine having the formula NR¹R²; R¹ and R² are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties; and Q has the formula:



158. A method according to claim 157, wherein R¹ is 2-hydroxyethyl, R² is methyl, and R³ is 6-hydroxyhexyl.

159. A method according to claim 156, wherein the dye has the formula:



wherein

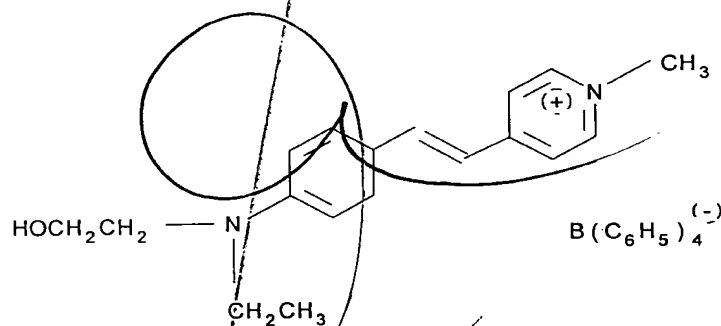
$R^1$  and  $R^2$  are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties.

160. A method according to claim 159, wherein Y is tetraphenylborate or iodide.

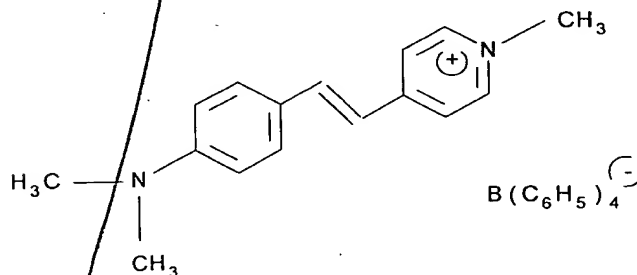
161. A method according to claim 159, wherein A and B are hydrogen and  $R^1$ ,  $R^2$ , and  $R^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

162. A method according to claim 161, wherein  $R^2$  is unsubstituted alkyl and  $R^1$  and  $R^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

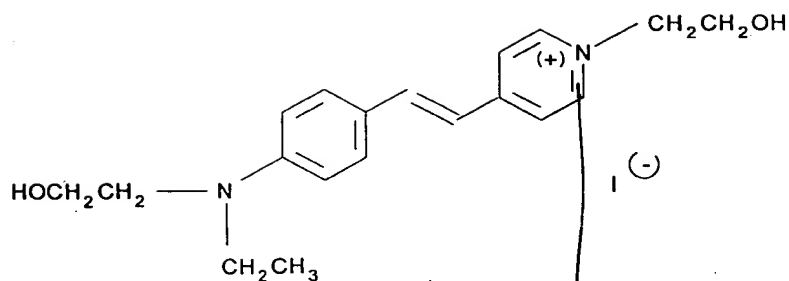
163. A method according to claim 159, wherein the dye has the formula:



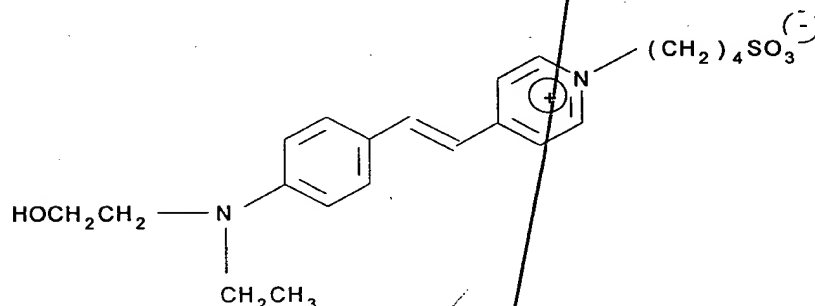
164. A method according to claim 159, wherein the dye has the formula:



165. A method according to claim 159, wherein the dye has the formula:



166. A method according to claim 159, wherein the dye has the formula:



167. A method according to claim 149, wherein the photosensitizer is present in the composition in a concentration of from about 0.5 to about 150 mg/ml of the composition.

168. A method according to claim 149, wherein the dye is present in the composition in a concentration of from about 0.5 to about 350 mg/ml of the composition.

169. A method according to claim 149, wherein said dye to said photosensitizer molar ratio is about 500:1 to about 1:20.

170. A method of killing cells or viruses comprising:  
 providing proximate to the cells or viruses an effective amount of a photosensitizer having absorption at a wavelength from about 380 nm to about 760 nm;  
 providing proximate to the cells or viruses an effective amount of a dye capable of converting photons having energies of from about 660 to about 1300 nm to photons having an energies of from about 380 to about 760 nm; and

exposing the dye to light having a wavelength of from about 660 to about 1300 nm in the presence of oxygen under conditions effective to produce a cytotoxic effect on the cells or viruses.

171. A method according to claim 170, further comprising:  
allowing the photosensitizer to accumulate on the cells or viruses prior to said exposing the dye.

172. A method according to claim 170, wherein the photosensitizer and the dye are provided together.

173. A method according to claim 172, wherein the photosensitizer and the dye are covalently bonded.

174. A method according to claim 170, wherein the photosensitizer is a singlet oxygen generator.

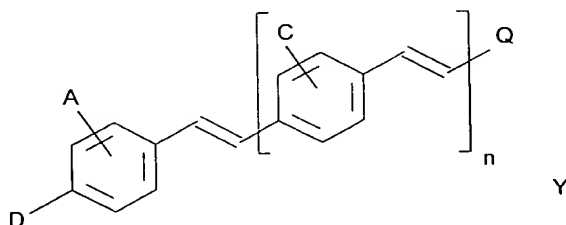
175. A method according to claim 170, wherein the photosensitizer is a photodynamic therapy agent.

176. A method according to claim 170, wherein the photosensitizer is a porphyrin, a porphyrin analog, a phthalocyanine, or a phthalocyanine analog.

177. A method according to claim 170, wherein the photosensitizer is dihematoporphyrin ether.

178. A method according to claim 170 wherein the dye is a two photon upconverter.

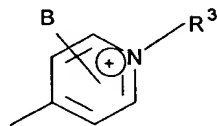
179. A method according to claim 170, wherein the dye is a styryl dye having the formula:



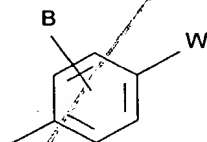
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

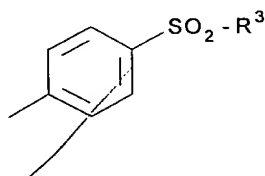
R<sup>3</sup> is a substituted or unsubstituted alkyl moiety or a substituted or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

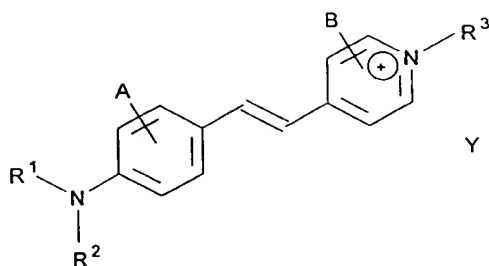
Y is a counterion

180. A method according to claim 179, wherein n is 0; A is hydrogen; D is an amine having the formula NR<sup>1</sup>R<sup>2</sup>; R<sup>1</sup> and R<sup>2</sup> are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties; and Q has the formula:



181. A method according to claim 180, wherein R<sup>1</sup> is 2-hydroxyethyl, R<sup>2</sup> is methyl, and R<sup>3</sup> is 6-hydroxyhexyl.

182. A method according to claim 179, wherein the dye has the formula:



wherein

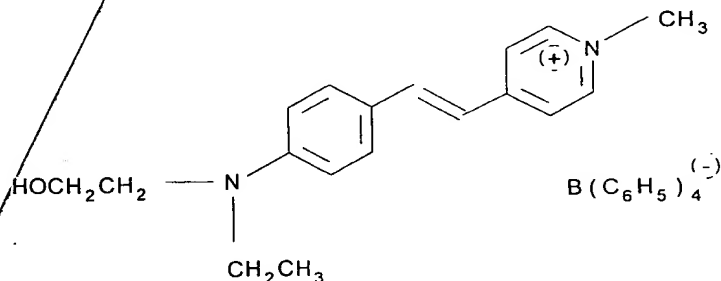
$R^1$  and  $R^2$  are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties.

183. A method according to claim 182, wherein Y is tetraphenylborate or iodide.

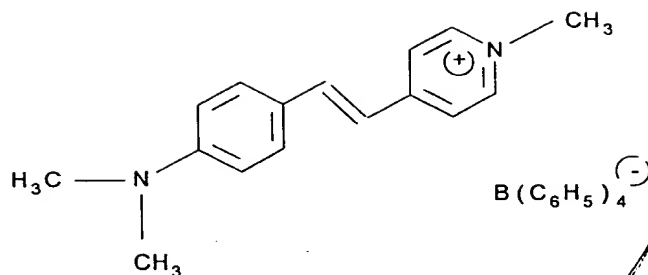
184. A method according to claim 182, wherein A and B are hydrogen and  $R^1$ ,  $R^2$ , and  $R^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

185. A method according to claim 184, wherein  $R^2$  is unsubstituted alkyl and  $R^1$  and  $R^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

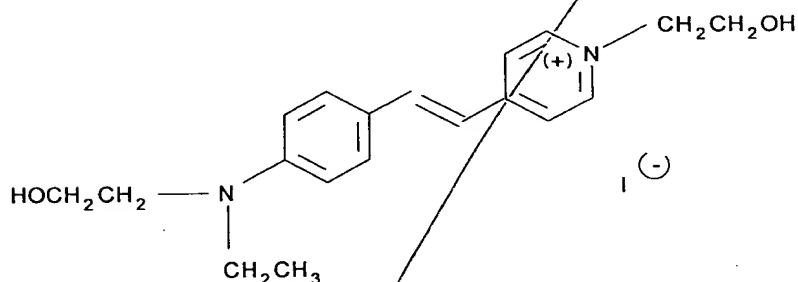
186. A method according to claim 182, wherein the dye has the formula:



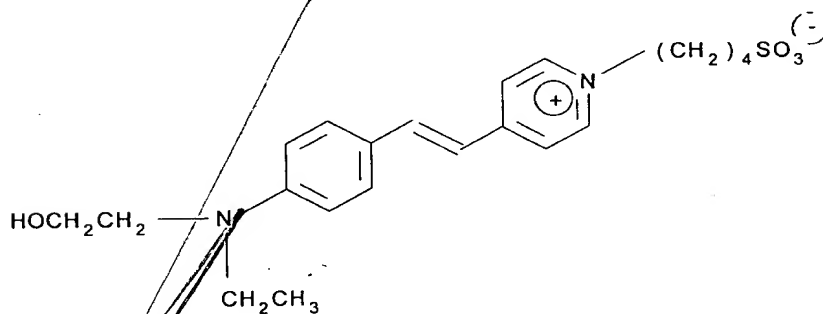
187. A method according to claim 182, wherein the dye has the formula:



188. A method according to claim 182, wherein the dye has the formula:



189. A method according to claim 182, wherein the dye has the formula:



190. A method according to claim 170, wherein the light is Ti-sapphire laser light having a wavelength of from about 780 to about 800 nm.

191. A method according to claim 170, wherein the cells or viruses are in vitro.

192. A method according to claim 191, wherein the cells or viruses are contained in a sample of blood.

193. A method according to claim 170, wherein the cells are cancer or tumor cells.

194. A method according to claim 193, wherein said providing the dye is effected by administering to the mammal a therapeutically effective amount of the dye and wherein said providing the photosensitizer is effected by administering to the mammal a therapeutically effective amount of the photosensitizer.

195. A method according to claim 194, wherein the photosensitizer is administered in an amount of from about 0.1 to about 10 mg/kg of the mammal's body weight.

196. A method according to claim 194, wherein the dye is administered in an amount of from about 0.1 to about 50 mg/kg of the mammal's body weight.

197. A method according to claim 194, wherein the photosensitizer and the dye are coadministered.

198. A method according to claim 197, wherein the photosensitizer and the dye are covalently bonded.

199. A composition comprising:  
a photosensitizer having absorption at a wavelength of from about 380 nm to about 760 nm and  
a dye capable of converting photons having energies of from about 660 to about 1300 nm to photons having energies of from about 380 nm to about 760 nm.

200. A composition according to claim 199, wherein said photosensitizer and said dye are covalently bonded.

201. A composition according to claim 199, wherein said photosensitizer and said dye are encapsulated in a liposome.

202. A composition according to claim 199, wherein said dye to said photosensitizer molar ratio is about 500:1 to about 1:20.

203. A composition according to claim 199, further comprising a pharmaceutically acceptable excipient.

204. A composition according to claim 203, wherein said dye is present in a concentration of from about 0.5 to about 350 mg/ml of said excipient.

205. A composition according to claim 203, wherein said photosensitizer is present in a concentration of from about 0.5 to about 150 mg/ml of said excipient.

206. A method according to claim 199, wherein the photosensitizer is a singlet oxygen generator.

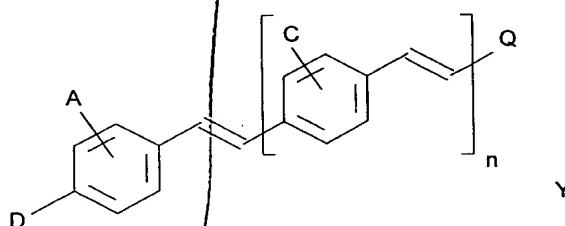
207. A method according to claim 199, wherein the photosensitizer is a photodynamic therapy agent.

208. A composition according to claim 199, wherein said photosensitizer is a porphyrin, a porphyrin analog, a phthalocyanine, or a phthalocyanine analog.

209. A composition according to claim 199, wherein said photosensitizer is dihematoporphyrin ether.

210. A composition according to claim 199, wherein said dye is a two photon upconverter.

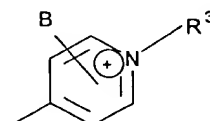
211. A composition according to claim 199, wherein said dye is a styryl dye having the formula:



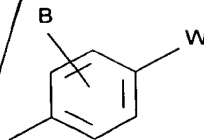
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

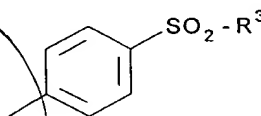
R<sup>3</sup> is a substituted or unsubstituted alkyl moiety or substituted or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

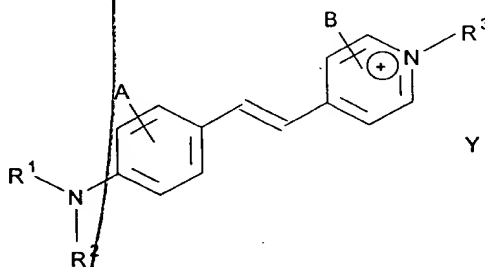
Y is a counterion

212. A composition according to claim 211, wherein n is 0; A is hydrogen; D is an amine having the formula NR<sup>1</sup>R<sup>2</sup>; R<sup>1</sup> and R<sup>2</sup> are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties; and Q has the formula:



213. A composition according to claim 212, wherein R<sup>1</sup> is 2-hydroxyethyl, R<sup>2</sup> is methyl, and R<sup>3</sup> is 6-hydroxyhexyl.

214. A composition according to claim 211, wherein said dye has the formula:



wherein

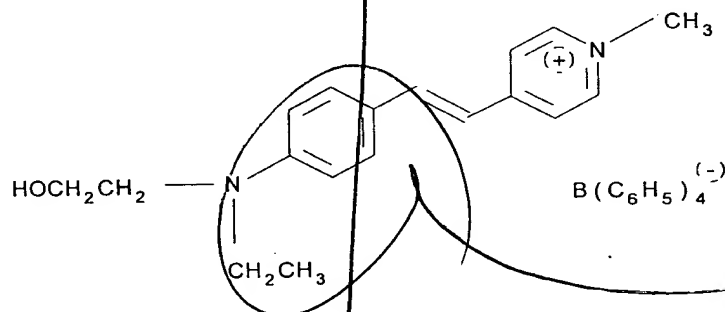
R<sup>1</sup> and R<sup>2</sup> are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties.

215. A composition according to claim 214, wherein Y is tetraphenylborate or iodide.

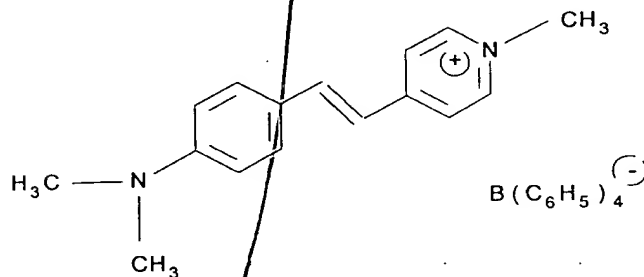
216. A composition according to claim 214, wherein A and B are hydrogen and R<sup>1</sup>, R<sup>2</sup>, and R<sup>3</sup> are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

217. A composition according to claim 216, wherein R<sup>2</sup> is unsubstituted alkyl and R<sup>1</sup> and R<sup>3</sup> are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

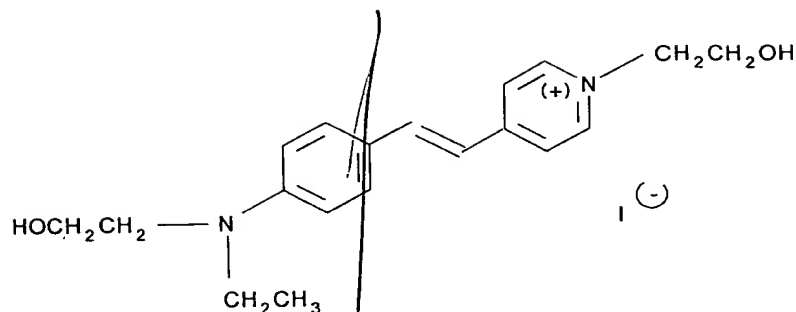
218. A composition according to claim 214, wherein said dye has the formula:



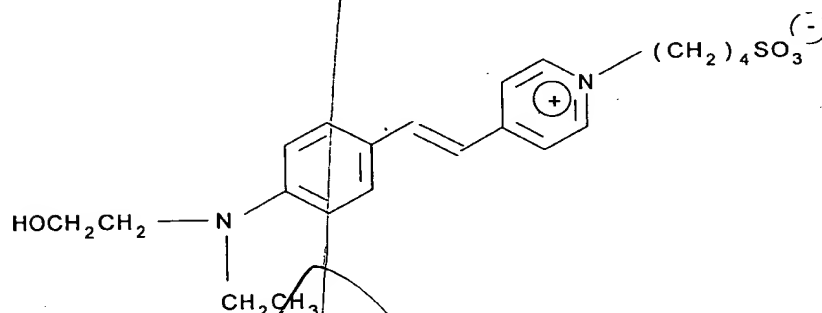
219. A composition according to claim 214 wherein said dye has the formula:



220. A composition according to claim 214, wherein said dye has the formula:



221. A composition according to claim 214, wherein said dye has the formula:



222. A method for recording data comprising:  
 providing a three dimensional matrix comprising a plurality of dye molecules; and  
 exposing a first volume element in the three-dimensional matrix to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in the first volume element, wherein the fraction is between about 0.3 and about 0.7 and wherein the detectably altered dye molecules are substantially uniformly dispersed in the first volume element.

223. A method according to claim 222, wherein the matrix comprises a polymer selected from the group consisting of poly(methyl methacrylate), poly(2-hydroxyethyl methacrylate), and combinations thereof.

224. A method according to claim 222, wherein the first volume element has a volume of from about  $0.001 \mu\text{m}^3$  to about  $10 \mu\text{m}^3$ .

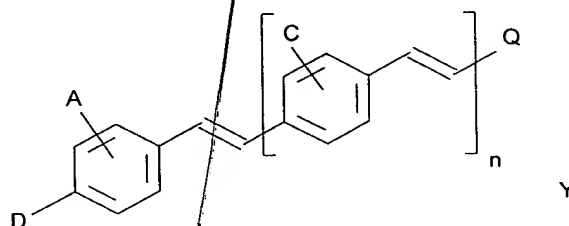
225. A method according to claim 222, wherein the concentration of the dye molecules in the matrix is from about 0.001 M to about 0.4 M.

226. A method according to claim 222, wherein the dye molecules are detectably altered by a two-photon upconversion process.

227. A method according to claim 226, wherein the dye molecules are detectably altered by a two-photon upconversion photobleaching process.

228. A method according to claim 222, wherein the dye molecules have a two-photon absorption cross section of greater than about  $1 \times 10^{-50} \text{ cm}^4\text{-sec}$ .

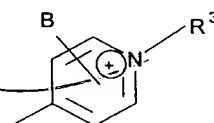
229. A method according to claim 222, wherein the dye molecules have the formula:



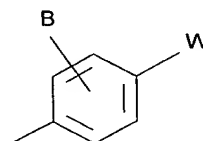
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

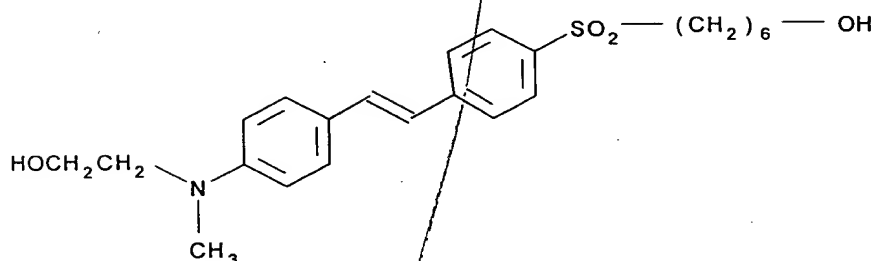
$R^3$  is a substituted or unsubstituted alkyl moiety or a substituted or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion.

230. A method according to claim 229, wherein the dye molecules have the formula:



231. A method according to claim 222, wherein the fraction of the dye molecules detectably altered in the first volume element is controlled by adjusting the duration for which the first volume element is exposed to the actinic radiation.

232. A method according to claim 222, wherein the fraction of the dye molecules detectably altered in the first volume element is controlled by adjusting the intensity to which the first volume element is exposed.

233. A method according to claim 222 further comprising:  
 exposing a second volume element to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in the second volume element, wherein the fraction of the dye molecules detectably altered in the second volume element is detectably different than the fraction of the dye molecules detectably altered in the first volume element; and  
 exposing a third volume element to actinic radiation under conditions effective to alter detectably a fraction of the dye molecules contained in the third volume element, wherein the fraction of the dye molecules detectably altered in the third volume element is detectably different than the fraction of the dye molecules detectably altered in the first and second volume elements.

234. A method according to claim 222 further comprising:  
 exposing, individually, each of 254 additional volume elements to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in each of the 254 additional volume elements, wherein the fraction of the dye molecules detectably altered in each of the 254 additional volume elements is detectably different than the fraction of the dye

molecules detectably altered in each of the other 254 additional volume elements and in the first volume element.

235. A method according to claim 222, wherein the actinic radiation is laser radiation.

236. A method according to claim 235, wherein the laser radiation is focused, pulsed laser radiation having an intensity of from about  $1 \text{ MW}/\mu\text{m}^2$  to about  $100 \text{ MW}/\mu\text{m}^2$  at the first volume element.

237. A method according to claim 235, wherein the laser radiation is provided by a laser beam focused on the first volume element.

238. A method according to claim 237, wherein the laser beam is focused on the first volume element by a confocal microscope.

239. A method according to claim 235, wherein the laser radiation is provided by two or more laser beams which intersect at the first volume element.

240. A method according to claim 235, wherein the laser radiation is provided by a laser beam and wherein said method further comprises:  
moving the laser beam relative to the matrix to another volume element and  
exposing the another volume element to the laser radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in the another volume element.

241. A method according to claim 240, wherein the laser beam is focused at a focal point and wherein said moving comprises:  
shifting the laser beam relative to the matrix in an X-Y plane within the matrix, wherein the X-Y plane is orthogonal to the laser beam and  
shifting the laser beam's focal point relative to the matrix along a Z axis coincident with the laser beam.

242. A method according to claim 240, wherein the laser radiation is provided by two intersecting laser beams and wherein said moving comprises:  
shifting one of the laser beams relative to the matrix in an X-Y plane within the matrix and

shifting the second laser beam relative to the matrix in an X-Z plane within the matrix.

243. A method according to claim 222, wherein the data corresponds to a two-dimensional image comprising a two-dimensional array of pixels, each pixel having a value associated therewith, said method further comprising:

exposing a two-dimensional array of volume elements in three-dimensional matrix to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in each volume element, wherein the fraction of dye molecules detectably altered in each volume element correlates to the value associated with the corresponding pixel.

244. A method according to claim 243, wherein the value associated with each pixel is the pixel's gray level.

245. A method according to claim 243, wherein the image is a color image and wherein the value associated with each pixel is the pixel's color density.

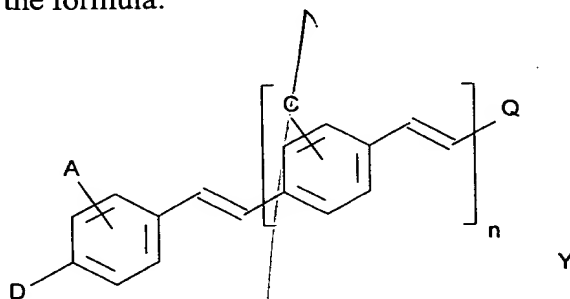
246. A method according to claim 243, wherein each pixel has a second value associated therewith, said method further comprising:

exposing a second two-dimensional array of volume elements in the three-dimensional matrix to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in each of the second two-dimensional array's volume elements, wherein the fraction of dye molecules detectably altered in each of the second two-dimensional array's volume elements correlates to the second value associated with the corresponding pixel.

247. A method according to claim 222, wherein the data corresponds to a number of two-dimensional images, each of the two-dimensional images comprising a two-dimensional array of pixels, each pixel having a value associated therewith, said method further comprising:

exposing a plurality of two-dimensional arrays of volume elements in the three-dimensional matrix to actinic radiation for a duration and at an intensity effective to alter detectably a fraction of the dye molecules contained in each of the plurality of two-dimensional arrays' volume elements, wherein the fraction of dye molecules detectably altered in each of the plurality of two-dimensional arrays' volume elements correlates to the value associated with the corresponding pixel of the corresponding pixel.

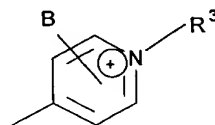
248. A method for recording data comprising:  
providing a three-dimensional matrix comprising a plurality of  
dye molecules having the formula:



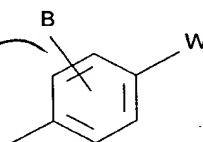
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of  
electron acceptors having the formulae:



and



W is an electron accepting group,

R<sup>3</sup> is a substituted or unsubstituted alkyl moiety or a substituted  
or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each  
independently selected from the group consisting of alkyl, alkoxy,  
hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

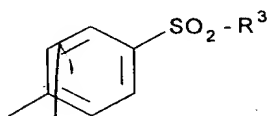
Y is a counterion

and

exposing at least one volume element in the three-dimensional  
matrix to actinic radiation under conditions effective to alter detectably all or a fraction  
of the dye molecules contained in the at least one of the volume elements.

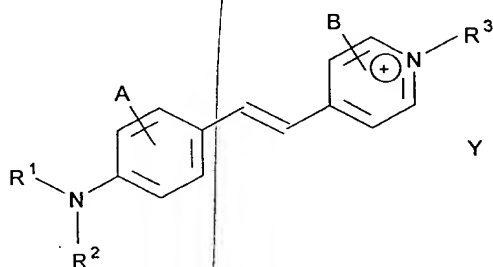
249. A method according to claim 248, wherein n is 0; A is hydrogen; D is an  
amine having the formula NR<sup>1</sup>R<sup>2</sup>; R<sup>1</sup> and R<sup>2</sup> are the same or different and are

substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties; and Q has the formula:



250. A method according to claim 248, wherein  $\text{R}^1$  is 2-hydroxyethyl,  $\text{R}^2$  is methyl, and  $\text{R}^3$  is 6-hydroxyhexyl.

251. A method according to claim 248, wherein the dye molecules have the formula:



wherein

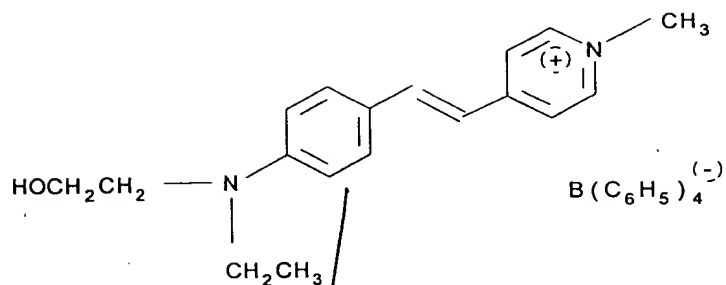
$\text{R}^1$  and  $\text{R}^2$  are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties.

252. A method according to claim 251, wherein Y is tetraphenylborate or iodide.

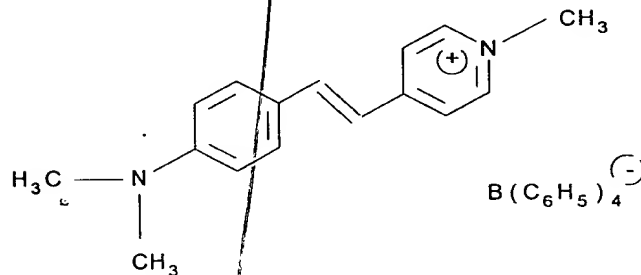
253. A method according to claim 251, wherein A and B are hydrogen and  $\text{R}^1$ ,  $\text{R}^2$ , and  $\text{R}^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

254. A method according to claim 253, wherein  $\text{R}^2$  is unsubstituted alkyl and  $\text{R}^1$  and  $\text{R}^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

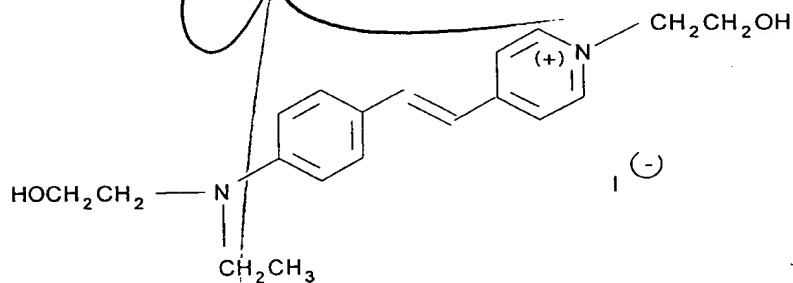
255. A method according to claim 248, wherein the dye molecules have the formula:



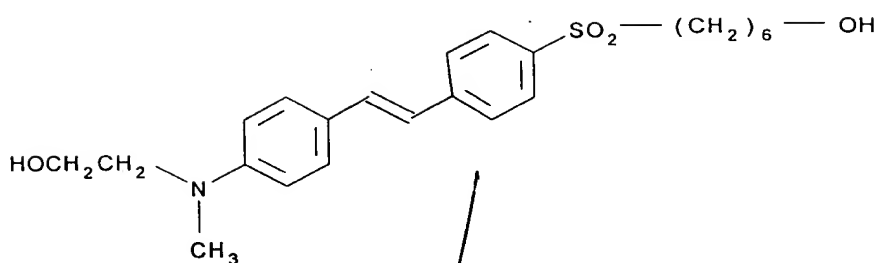
256. A method according to claim 248, wherein the dye molecules have the formula:



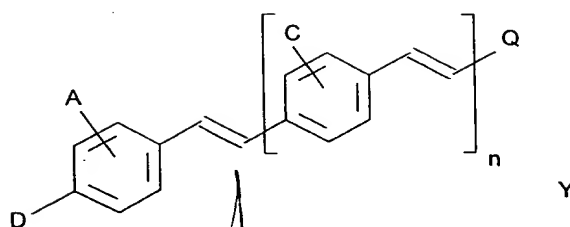
257. A method according to claim 248, wherein the dye molecules have the formula:



258. A method according to claim 248, wherein the dye molecules have the formula:



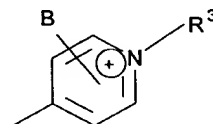
259. A data storage medium comprising:  
a three-dimensional matrix comprising a first volume element;  
a plurality of dye molecules substantially uniformly dispersed  
said three-dimensional matrix, wherein a fraction between about 0.3 and about 0.7 of  
the dye molecules contained in the first volume element are detectably altered and  
wherein the detectably altered dye molecules are substantially uniformly dispersed  
through the first volume element.
260. A data storage medium according to claim 259, wherein the matrix  
comprises a polymer selected from the group consisting of poly(methyl methacrylate),  
poly(2-hydroxyethyl methacrylate), and combinations thereof.
261. A data storage medium according to claim 259, wherein the first  
volume element has a volume of from about  $0.001 \mu\text{m}^3$  to about  $10 \mu\text{m}^3$ .
262. A data storage medium according to claim 259, wherein the  
concentration of the dye molecules in the matrix is from about 0.001 M to about 0.4 M.
263. A data storage medium according to claim 259, wherein the dye  
molecules are detectably alterable by a two-photon upconversion process.
264. A data storage medium according to claim 263, wherein the detectably  
altered dye molecules are photobleached.
265. A data storage medium according to claim 259, wherein the dye  
molecules have a two-photon absorption cross section of greater than about  $1 \times 10^{-50}$   
 $\text{cm}^4\text{-sec}$ .
266. A data storage medium according to claim 259, wherein the dye  
molecules have the formula:



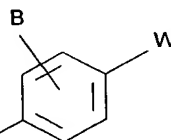
wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:



and



W is an electron accepting group,

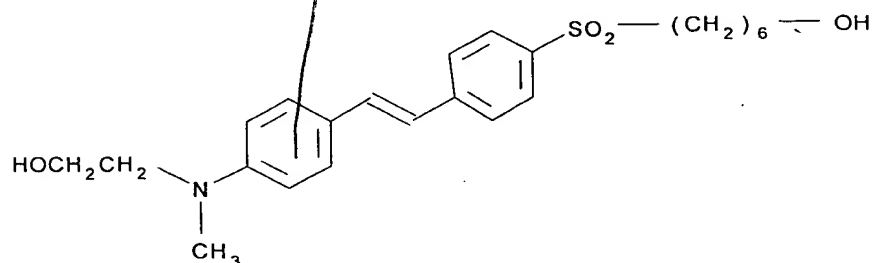
R<sup>3</sup> is a substituted or unsubstituted alkyl moiety or a substituted or unsubstituted aryl moiety,

n is an integer from 0 to 4,

A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and

Y is a counterion.

267. A data storage medium according to claim 266, wherein the dye molecules have the formula:



268. A data storage medium according to claim 259, wherein the three-dimensional matrix further comprises:

a second volume element, wherein a fraction of the dye molecules contained in the second volume element are detectably altered and wherein the fraction of the dye molecules detectably altered in the second volume element is detectably different than the fraction of the dye molecules detectably altered in the first volume element; and

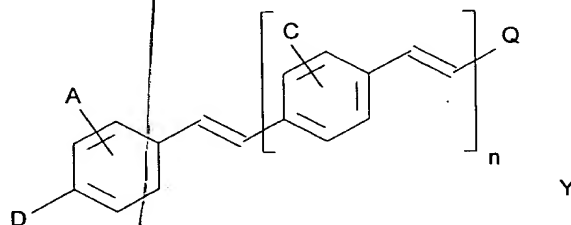
a third volume element, wherein a fraction of the dye molecules contained in the third volume element are detectably altered and wherein the fraction of the dye molecules detectably altered in the third volume element is detectably different than the fractions of the dye molecules detectably altered in the first and second volume elements.

269. A data storage medium according to claim 259, wherein the three-dimensional matrix further comprises:

254 additional volume elements, wherein a fraction of the dye molecules contained in each of the 254 additional volume elements are detectably altered and wherein the fraction of the dye molecules detectably altered in each of the 254 additional volume elements is detectably different than the fraction of the dye molecules detectably altered in each of the other 254 additional volume elements and in the first volume element.

270. A data storage medium comprising:

a three-dimensional matrix and  
a plurality of dye molecules having the formula:

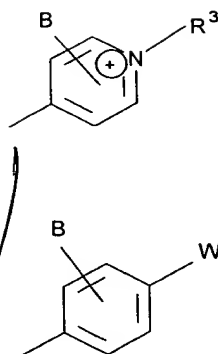


wherein

D is an electron donating group;

Q is an electron acceptor selected from the group consisting of electron acceptors having the formulae:

and

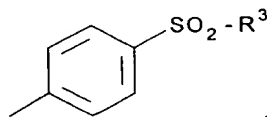


W is an electron accepting group,  
R<sup>3</sup> is a substituted or unsubstituted alkyl moiety or a substituted or unsubstituted aryl moiety,  
n is an integer from 0 to 4,  
A, B, and C are substituents of their rings and are each independently selected from the group consisting of alkyl, alkoxy, hydroxyalkyl, sulfoalkyl, carboxyalkyl, and hydrogen, and  
Y is a counterion

substantially uniformly dispersed in said three-dimensional matrix.

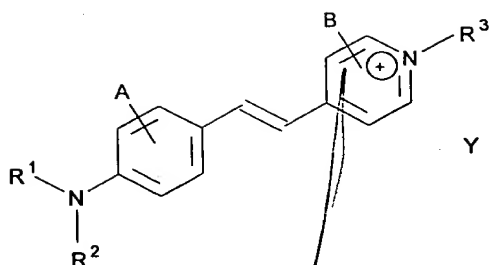
271. A data storage medium according to claim 270, wherein the three-dimensional matrix comprises a first volume element and wherein all or a fraction of the dye molecules contained in the first volume element are detectably altered.

272. A data storage medium according to claim 270, wherein n is 0; A is hydrogen; D is an amine having the formula  $\text{NR}^1\text{R}^2$ ; R<sup>1</sup> and R<sup>2</sup> are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties; and Q has the formula:



273. A data storage medium according to claim 270, wherein R<sup>1</sup> is 2-hydroxyethyl, R<sup>2</sup> is methyl, and R<sup>3</sup> is 6-hydroxyhexyl.

274. A data storage medium according to claim 270, wherein the dye molecules have the formula:



wherein

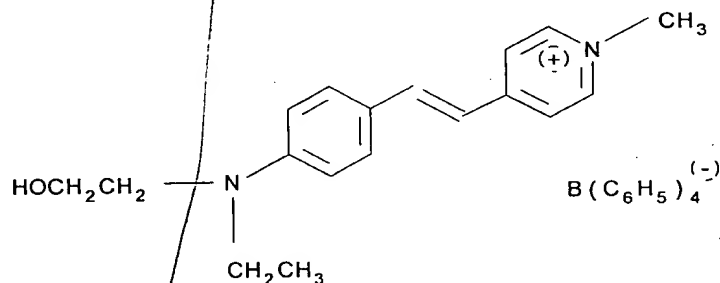
$R^1$  and  $R^2$  are the same or different and are substituted or unsubstituted alkyl moieties or substituted or unsubstituted aryl moieties.

275. A data storage medium according to claim 274, wherein Y is tetraphenylborate or iodide.

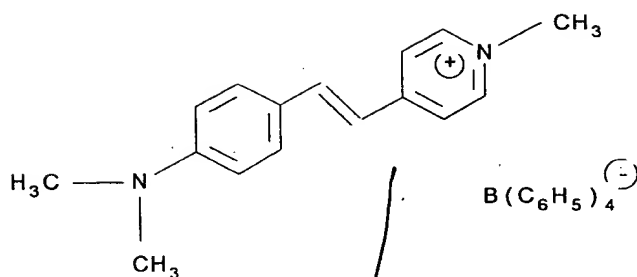
276. A data storage medium according to claim 274, wherein A and B are hydrogen and  $R^1$ ,  $R^2$ , and  $R^3$  are the same or different and are selected from the group consisting of unsubstituted alkyl, hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

277. A data storage medium according to claim 276, wherein  $R^2$  is unsubstituted alkyl and  $R^1$  and  $R^3$  are selected from the group consisting of hydroxyalkyl, sulfoalkyl, and carboxyalkyl.

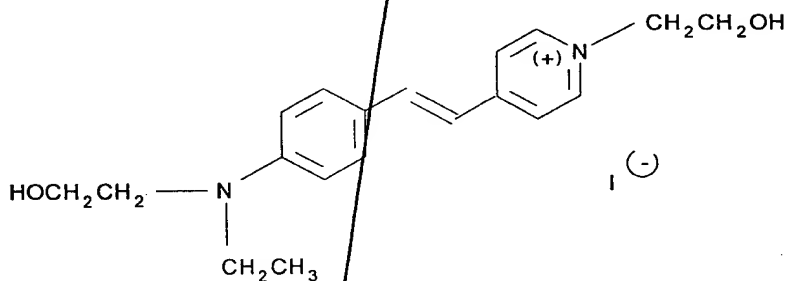
278. A data storage medium according to claim 270, wherein the dye molecules have the formula:



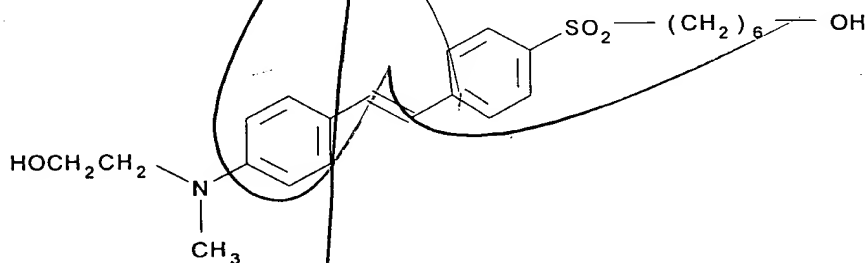
279. A data storage medium according to claim 270, wherein the dye molecules have the formula:



280. A data storage medium according to claim 270, wherein the dye molecules have the formula:



281. A data storage medium according to claim 270, wherein the dye molecules have the formula:



282. A method of reading data comprising:  
providing an data storage medium according to claim 259 and  
detecting the fraction of the dye molecules contained in the first  
volume element that are detectably altered.

283. A method according to claim 282, wherein the dye molecules are two-  
photon upconversion fluorescers and wherein the detectably altered dye molecules are  
photobleached, said detecting comprising:

exposing the first volume element to actinic radiation effective to induce the dye molecules in the first volume element other than the detectably altered dye molecules to two-photon upconversion fluorescence;  
detecting the fluorescence; and  
correlating the fluorescence with the fraction of the dye molecules contained in the first volume element that are detectably altered.

284. A method according to claim 283, wherein the detecting is carried out using a confocal microscope.

285. A method according to claim 283, wherein the exposing the first volume element to actinic radiation is ineffective to photobleach the dye molecules contained in the first volume element.

286. A method for reading data comprising:  
providing a data storage medium according to claim 271 and  
detecting the fraction of the dye molecules contained in the first volume element that are detectably altered.

287. A method according to claim 286, wherein the detectably altered dye molecules are photobleached, said detecting comprising:  
exposing the first volume element to actinic radiation effective to induce the dye molecules in the first volume element other than the detectably altered dye molecules to two-photon upconversion fluorescence;  
detecting the fluorescence; and  
correlating the fluorescence with the fraction of the dye molecules contained in the first volume element that are detectably altered.

288. A method according to claim 287, wherein the detecting is carried out using a confocal microscope.

289. A method according to claim 287, wherein the exposing the first volume element to actinic radiation is ineffective to photobleach the dye molecules contained in the first volume element.

*add B*